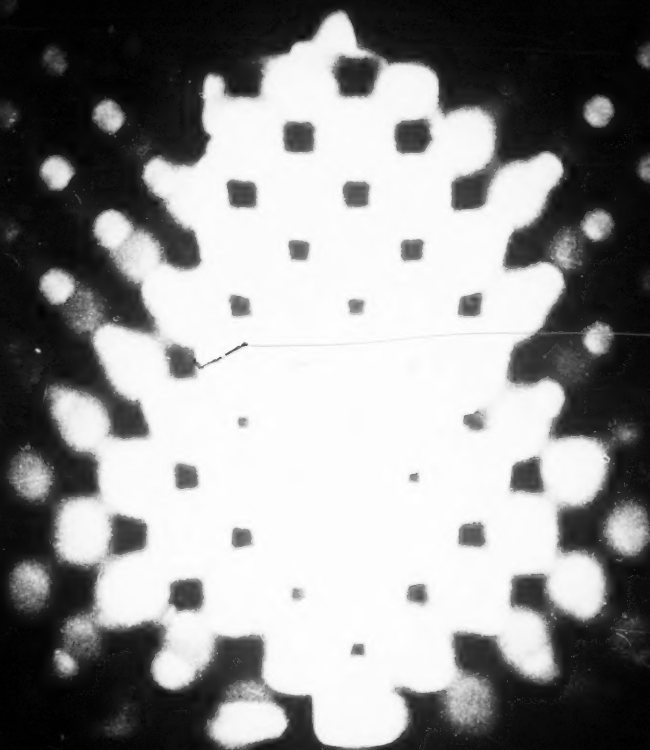


Chemical company earnings
continue to rise in first quarter
Page 9

MAY 15, 1989

CHEMICAL & ENGINEERING

NEWS



**Diamond
Thin Films**
Page 24

News of the Week

■ **Launch of Magellan spacecraft from shuttle for voyage to Venus kicks off new era of planetary exploration.** Page 4

■ **Federal judge overrules as too strict the standards used to deal with claims of agent orange damage to Vietnam veterans.** Page 5

■ **Electrochemical Society meeting hears replay of the conflicting results obtained by scientists running cold fusion experiments, and some admissions of error by Utah electrochemists.** Page 5

■ **Sterling Drug will move most of the scientists and support staff at its Rensselaer, N.Y., research facilities to a Pennsylvania site; about 150 positions will be eliminated.** Page 6

■ **Another study, this time from a Senate subcommittee, is strongly critical of EPA's implementation of its Superfund program.** Page 6

Cover: Closeup view of microwave plasma used to produce diamond thin films at Penn State's Materials Research Laboratory. Photo by Bruce Frisch

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Earnings of major U.S. chemical firms increased an average 22% in the first quarter, still substantial but lower than in previous quarters. Page 9

Bayer USA head Konrad Weis, 1989 Palladium medalist, reflects on Bayer's growth in the U.S. market, plans for the future. Page 13

Changing global operating environment is pushing chemical companies toward globalization. Page 15

Steel treatment firm Meridian National is branching into acid waste treatment business. Page 16

Government

Conferees at forum on global climate change urge international efforts to deal effectively with climate issues and to ward off potential environmental disasters. Page 18

Education

First ACS satellite teleconference course on synthetic polymer techniques airs, four-hour session reaches 1000 at 43 North American sites. Page 21

Science/Technology

Research on catalytic converters for autos has led to a decrease in hydrocarbon, nitrogen oxides pollution and to a better understanding of noble-metal catalysis. Page 23



Special Report

Advances in material sciences are paving the way for use of synthetic diamond in thin film coatings that confer on the coated material the hardness and the electronic and optical properties that only diamond has. Page 24

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LETTERS

Views on nuclear fusion

SIR: Your editorial (C&EN, April 3, page 3) regarding the need for the scientific community to address the problem of acceptable ways for communicating interesting results to the press (science and other) is extremely important.

In passing, however, it must be noted that B. Stanley Pons and Martin Fleischmann were veritable paragons of model behavior compared with what happened in the high- T_c superconductors. Indeed, even the science and secular press were much more restrained, partly because they themselves had been very careless in how they handled the superconductor hype emanating from some universities. The code that I proposed after that sorry episode was as follows:

- Major scientific societies agree, and publish a notice, that they will in no case publish (in any of their journals) any paper describing research that has been released to the press before a scientific paper has been submitted to the journal. Copies of the preprint must be available upon request from that time on. The submission requirement is the only workable one, since once submitted the result is public anyway. Neither the society nor referees are held to any confidentiality.

- Major newspapers and scientific publications agree not to print any such stories if no submitted preprints are available with them. These publications also clearly separate in their stories any report on the scientific results from any analysis or speculation of future potential of resulting technologies, etc. Moreover, they should take the utmost care that such analysis be evenhanded with optimistic and pessimistic views of named experts both presented. Here again, the fusion reports have been much more modest compared with the systematic suppression of any cautionary views in the high- T_c superconductor case.

The other issue certainly for a scientific journal and at least society science magazines in the case of such step-function advances is to be careful about giving proper credit to antecedent and/or parallel work, especially if it is foreign. To the best of my very limited knowledge in the fusion story, this was also better handled. Even so, it is interesting to remind your readers that room-temperature lab-scale neutron production was reported in a Soviet journal in 1986.

Please keep up the pressure on our collective scientist conscience to devise some guidelines to protect the public

from this kind of "soft cheating," which is in many ways much more prevalent and more damaging to society than the more notorious but probably much rarer painting of mice and other kinds of fraud.

Rustum Roy

Evan Pugh Professor of the Solid State
Pennsylvania State University

SIR: I am writing to propose an explanation for the thermal effects reported in the room-temperature fusion experiments that have science in an uproar.

Finding energy released from the device to be four times greater than that supplied by the electrical source appears to be a violation of the first law of thermodynamics unless nuclear phenomena are considered. Another logical explanation is found, however, in the second law.

The energy supplied is "work." That discharged is "heat." A heat pump is capable of delivering an amount of heat at the hot junction that is many times greater than the work provided. The maximum theoretical ratio of heat to work depends on the absolute temperature and the difference in temperature between the heat source and the sink.

One of the simplest of heat engines is the "thermocouple," which consists of two different electrical conductors joined at both ends and having a switch somewhere in the circuit. If one junction is heated above the other and current is allowed to flow, electrons passing from conductor A to conductor B at the hot junction absorb heat. Electrons pass from B to A at the cold junction and heat is discharged. A net electromotive potential is generated in the circuit, and the system is capable of performing work. This phenomenon is known as the Seebeck effect. The first law requires that heat absorbed at the hot junction exceed that delivered by the cold one. Heat absorbed must also be considerably greater than the work output. Thermocouples are most commonly used to measure temperature differences by monitoring the open-circuit voltage, but the same scheme can be used to convert heat to work with the device operating as a heat engine.

Electrical current in the thermocouple can, of course, be reversed. Then, work must be supplied, heat is absorbed at the cold junction and is discharged at the hot junction. It now becomes a heat pump or refrigerator, depending on one's perspective. The theoretical ratio of heat discharged to work provided in a

Growth in Chemical Earnings Slows in First Quarter

Rising raw material costs plus failure of prices to keep pace are beginning to squeeze many U.S. chemical producers

William J. Storck,
C&EN Northeast News Bureau

Not so long ago a 22% increase in earnings would have been cause for the U.S. chemical industry to celebrate. But now, after a number of heady quarters for the industry, such a rise represents a considerable slowing of growth.

In fact, 22% is the lowest increase since the third quarter of 1986. This growth rate was the average for 30 major U.S. chemical companies regularly surveyed by C&EN in its quarterly report of chemical industry sales and earnings. Earnings growth slowed for many oil and diversified companies as well.

The slowdown in earnings is not to say that business was bad in the first quarter this year. The govern-

ment's producer price index for chemicals and allied products increased 11% on average in the quarter over the same period in 1988. And production of chemicals and allied products was up about 8.5% for the quarter. However, this represents a slowing from the 8.9% annual growth recorded in the fourth quarter of 1988.

Further, growth in the demand for chemicals, although still high, seems to be slowing from last year. Government figures show that shipments of chemicals and allied products for the first quarter increased about 8.6%, down from 13% growth in fourth-quarter 1988 and from 13% growth for all of last year. The same pattern holds true for basic chemicals, where first-quarter shipments were up 8.3% from the same period a year earlier. In the fourth quarter, basic chemical shipments increased 9.0% on average and about 10% for all of 1988.

Though business was good in the first quarter, margins shrank for many companies producing downstream chemical products because raw material costs were rising faster

than selling prices. For instance, H. B. Fuller Co., whose profits plummeted 59% in the quarter, says, "A significant decline in margins due to raw material cost increases was experienced in the first quarter. Pricing action has been taken to rectify the situation and margin improvement is noted from the fourth quarter of 1988."

American Cyanamid also notes a cost-price problem in its chemicals group. However, it says that the situation appears to be improving from the latter part of 1988. At Monsanto, which also notes the problem, chairman and chief executive officer Richard J. Mahoney believes that raw material costs have peaked.

Some companies see things differently, however. At Union Carbide, for instance, where earnings almost doubled, Robert D. Kennedy, chairman and chief executive officer, says that sales volume continues to be strong and the company continues to benefit from favorable raw material costs.

Also companies note that plant startup, increasing employment, and other operating expenses were

Chemical industry leaders for first-quarter 1989

Sales		
Rank 1989	\$ Millions	Rank 1988
1 Dow Chemical	\$4485.0	1
2 Monsanto	2265.0	2
3 Union Carbide	2241.0	3
4 W. R. Grace	1397.2	4
5 American Cyanamid	1231.6	5
6 Quantum Chemical	814.1	6
7 Ethyl	729.1	8
8 Arco Chemical	699.0	11
9 Hercules	681.8	7
10 Rohm & Haas	679.5	9

Earnings*		
	\$ Millions	Rank 1988
Dow Chemical	\$743.0	1
Monsanto	222.0	2
Union Carbide	201.0	4
Arco Chemical	116.0	3
American Cyanamid	89.0	6
Quantum Chemical	71.4	5
Air Products	56.8	8
Ethyl	56.4	9
Georgia Gulf	55.4	13
Rohm & Haas	53.1	7

Profitability		
	Earnings as % of sales	Rank 1988
Great Lakes Chemical	19.7%	nr
Georgia Gulf	17.4	3
International Flavors	16.9	4
Arco Chemical	16.6	2
Dow Chemical	16.6	7
Vista Chemical	16.4	5
Aristech	13.3	1
Loctite	12.1	13
Beitz Laboratories	10.6	8
Naico Chemical	10.1	8

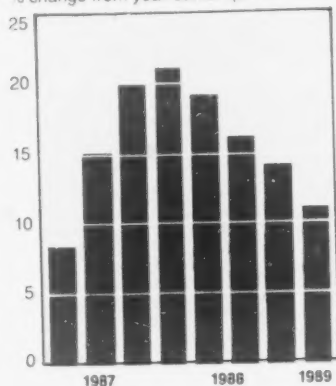
Note: Based on 30 chemical companies listed on page 11. * After taxes. nr = not ranked.

Chemical industry 1989 first-quarter results

- Sales increased 11%
- Earnings climbed 22%
- Profit margins were 10.1%
- Production rose 8.5%
- Prices jumped 11%

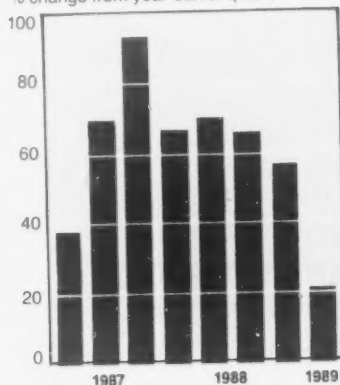
Sales

% change from year-earlier quarter



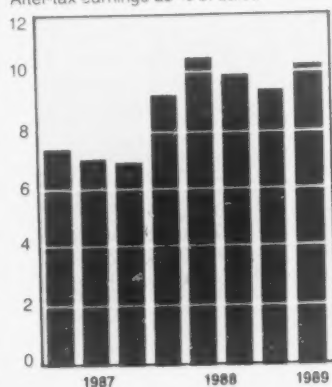
Earnings

% change from year-earlier quarter



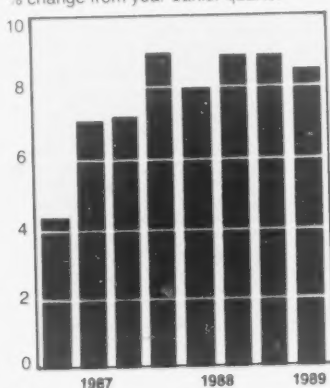
Profit margins

After-tax earnings as % of sales



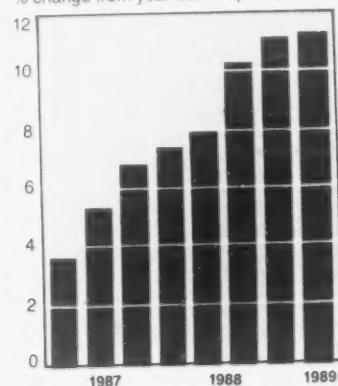
Production

% change from year-earlier quarter



Prices

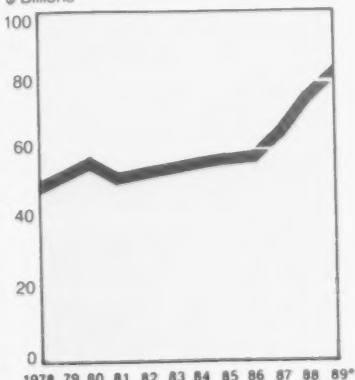
% change from year-earlier quarter



Sales in 1989 will rise about 8% and earnings will increase 15%, boosting profit margins to 10.4%

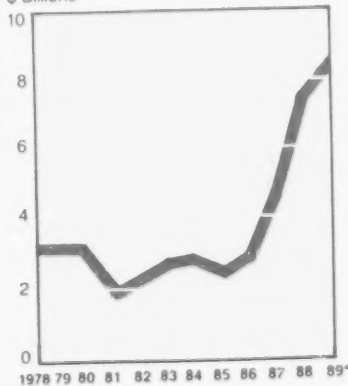
Annual sales

\$ Billions



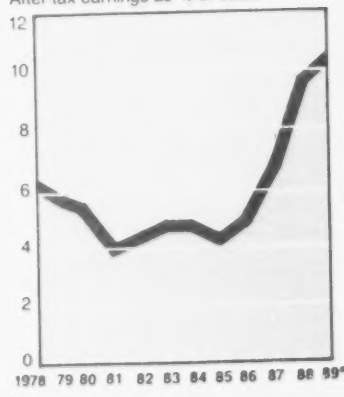
Annual earnings

\$ Billions



Annual profit margins

After-tax earnings as % of sales



Note: All sales, earnings, and profit-margin data are based on combined results of 30 companies listed on page 11. * C&EN estimates.

Sales and earnings continued to increase in first quarter

	FIRST-QUARTER 1989						12-MONTH RUNNING DATA			
	Sales		Earnings ^a		Change from 1988		Profit margin ^b		Change from 1988	
	(\$ millions)		Sales		Earnings		1989		1988	
Air Products ^c	\$ 668.9	\$ 56.6	8%	2%	8.5%	9.0%	11%	15%	8.7%	8.4%
American Cyanamid ^c	1,231.6	89.0	7	12	7.2	6.9	9	17	6.7	6.3
Arco Chemical ^c	699.0	116.0	20	7	16.6	18.5	35	59	17.8	15.1
Aristech	275.2	36.5	6	-31	13.3	20.2	11	88	13.7	8.1
Betz Laboratories	124.4	13.2	18	18	10.6	10.6	16	20	10.8	10.4
Cabot ^c	540.9	29.0	16	56	5.4	4.0	22	28	3.9	3.7
Chemed	141.9	5.3	42	17	3.7	4.6	36	6	4.0	5.1
Crompton & Knowles	87.8	5.3	57	43	6.1	6.7	40	42	5.4	5.3
Dow Chemical ^c	4,485.0	743.0	13	47	16.6	12.7	20	76	15.4	10.5
Ethyl ^c	729.1	56.4	12	6	7.7	8.2	25	17	10.4	11.0
First Mississippi	118.2	8.6	87	594	7.3	2.0	22	65	8.4	6.3
H. B. Fuller	177.6	1.9	15	-59	1.1	3.1	15	-32	2.6	4.4
Georgia Gulf	317.8	55.4	43	43	17.4	17.4	49	75	18.2	15.5
B. F. Goodrich ^c	639.0	53.0	16	30	8.3	7.4	11	97	9.2	5.2
W. R. Grace ^c	1,397.2	30.3	8	9	2.2	2.1	21	15	3.3	3.5
Great Lakes Chemical	145.1	28.6	4	19	19.7	17.2	12	59	19.1	13.5
Hercules ^c	681.6	37.1	3	-7	5.5	6.0	5	-30	5.0	7.4
International Flavors	227.2	38.5	1	7	16.9	16.0	7	14	15.6	14.6
International Minerals	258.4	22.0	12	-3	8.5	9.8	-41	-12	8.0	5.3
Loctite	116.4	14.1	7	35	12.1	9.6	11	33	11.5	9.6
Lubrizol	343.1	30.7	17	29	8.9	8.1	12	24	8.3	7.5
Monsanto ^c	2,265.0	222.0	6	6	9.8	9.9	7	19	7.2	6.4
Nalco Chemical	249.5	25.1	6	1	10.1	10.6	14	22	10.5	9.8
Olin ^c	671.0	34.0	18	17	5.1	5.1	19	25	4.3	4.1
Petrolite	72.4	3.1	-9	-34	4.3	5.9	0	-29	3.9	5.5
Quantum Chemical ^c	814.1	71.4	9	-25	8.8	12.8	15	75	11.9	7.8
Rohm & Haas ^c	679.5	53.1	10	-15	7.8	10.0	13	10	8.5	8.7
Union Carbide ^c	2,241.0	201.0	15	99	9.0	5.2	20	207	9.5	3.7
Vista Chemical	198.5	32.5	-8	12	16.4	13.4	7	45	16.4	12.1
Witco ^c	399.5	17.1	1	-14	4.3	5.1	7	10	5.0	4.9
Total 15 larger firms	\$18,142.4	\$1809.2	11%	25%	10.0%	8.8%	14%	53%	9.5%	7.1%
Smaller 15 firms	\$ 2,853.4	\$ 320.8	15%	10%	11.2%	11.7%	23%	41%	12.7%	11.0%
GRAND TOTAL	\$20,995.8	\$2130.0	11%	22%	10.1%	9.2%	15%	51%	10.0%	7.6%

a After-tax earnings from continuing operations excluding significant nonrecurring and extraordinary items. b After-tax earnings as a percentage of sales. c One of the 15 largest companies.

working to shrink margins in the first quarter.

The cost-price squeeze has created an even bigger split between the large chemical companies with more basic chemical business and the smaller firms, for which derivative products account for a larger share of earnings on C&EN's list of 30 major chemical companies.

Combined first-quarter earnings from continuing operations excluding significant nonrecurring and extraordinary items for the 30 companies climbed 22% to \$2.13 billion from the same period last year. Composite sales of these companies increased 11% to a total of almost \$21.0 billion. As a result, the aggregate

profit margin (earnings as a percentage of sales) rose to 10.1% in the first quarter of this year from 9.2% in the same period in 1988.

In terms of profit growth, the larger firms on the list outperformed the smaller ones and the bigger companies closed in on the smaller firms in terms of profitability.

For the 15 larger firms, combined earnings were up 25% to \$1.81 billion on a sales increase of 11% to \$18.1 billion. As a result, the profit margin for the group averaged 10.0%, up considerably from the 8.8% average recorded in first-quarter 1988.

The smaller firms, although leading in sales growth, averaged much

less earnings growth in the period, with combined after-tax results rising just 10% to \$321 million. Sales increased 15% to \$2.85 billion. But as sales rose faster than earnings, profit margins slipped to 11.2% in the first-quarter this year from 11.7% in the same period in 1988.

The effect of chemicals on earnings is evident in the first-quarter results of oil companies. For eight oil producers reporting chemical results—Amoco, Exxon, Chevron, Mobil, Occidental Petroleum, Shell, Texaco, and Unocal—combined earnings from these operations climbed 75% in the quarter to almost \$1.5 billion. This figure is slightly misleading in that Occiden-

Earnings declined at many oil firms, rose at others

	FIRST-QUARTER 1989					
	Sales	Earnings ^a	Change from 1988		Profit margin ^b	
	(\$ millions)		Sales	Earnings	1989	1988
OIL AND GAS COMPANIES						
American Petroleum	\$ 718.9	\$ 48.8	19%	60%	6.8%	5.0%
Amoco	6,526.0	458.0	14	-2	7.0	8.2
Ashland	1,900.0	-5.0	0	def	def	1.1
Chevron	7,700.0	313.0	3	-29	4.1	5.9
Exxon	22,244.0	1,270.0	1	-13	5.7	6.6
Kerr-McGee	717.1	33.9	8	225	4.7	1.6
Mobil	14,024.0	429.0	1	-22	3.1	3.9
Occidental Petroleum	5,143.0	76.0	15	31	1.5	1.3
Phillips Petroleum	3,102.0	190.0	7	46	6.1	4.5
Shell Oil	5,178.0	362.0	2	2	7.0	7.0
Sun Co.	2,650.0	81.0	11	35	3.1	2.5
Texaco	9,610.0	265.0	10	-2	2.8	3.1
Unocal	2,637.0	87.0	14	98	3.3	1.9
DIVERSIFIED MANUFACTURERS						
Allied-Signal	2,942.0	126.0	0	13	4.3	3.8
Borden	1,803.9	59.0	13	13	3.3	3.3
Du Pont	8,674.0	736.0	10	25	8.5	7.5
Eastman Kodak	3,900.0	200.0	17	-23	5.1	7.8
Engelhard	587.3	14.4	15	7	2.4	2.6
FMC	837.1	30.0	17	24	3.6	3.4
Ferro	271.5	12.4	13	11	4.6	4.6
3M	3,017.0	318.0	8	15	10.5	9.9
Morton-Thiokol	708.7	0.5	17	-99	0.1	6.9
PPG Industries	1,459.0	129.8	6	9	8.9	8.6
Tyler	163.6	-2.0	7	def	def	1.9
Vulcan Materials	217.5	15.7	7	1	7.2	7.7
PHARMACEUTICAL COMPANIES						
American Home Products	1,519.8	263.8	8	11	17.4	16.8
Baxter Travenol	1,774.0	101.0	9	11	5.7	5.6
Becton Dickinson	462.9	41.6	8	15	9.0	8.4
Bristol-Myers	1,602.2	237.1	5	13	14.8	13.9
Eli Lilly	1,225.0	284.7	14	22	23.2	21.8
Merck	1,571.4	340.4	9	25	21.7	18.9
Pfizer	1,436.3	240.8	11	10	16.8	16.9
Rorer Group	241.2	9.8	10	17	4.1	3.8
Schering-Plough	831.8	125.7	11	24	15.1	13.5
SmithKline Beckman	1,241.8	130.2	7	-22	10.5	14.3
Upjohn	755.1	103.0	14	8	13.6	14.4
Warner Lambert	1,019.7	101.1	10	21	9.9	9.0

^a After-tax earnings from continuing operations excluding significant nonrecurring and extraordinary items. ^b After-tax earnings as a percentage of sales. def = deficit.

tal's results include earnings from Cain Chemicals, acquired by Occidental after the first quarter of 1988. Even excluding Occidental, however, composite earnings for the remaining seven companies increased 65% to \$1.22 billion. The 75% chemical earnings gain contrasts with an 11% total earnings decline for these eight oil companies.

For 13 oil companies surveyed by

C&EN, combined first-quarter earnings fell 7% to \$3.61 billion from the year-earlier quarter on sales up 5% to \$82.2 billion. This resulted in a profit margin of 4.4% for the group in the first quarter compared with 5.0% in the same quarter in 1988.

In spite of the lower earnings gain than in previous quarters, the chemical industry continues to outperform other industries in terms of

sales and earnings growth. It was beaten, among industry groups surveyed, only by pharmaceuticals in return on sales.

For 12 pharmaceutical companies, composite first-quarter sales increased 9% to \$13.7 billion and earnings rose 13% to \$1.28 billion. Profit margins for the 12 firms averaged 14.5% in the first quarter, up from 14.0% in the same period last year.

And for 12 companies classified as diversified and other, combined sales in the first quarter rose 10% to \$24.6 billion and earnings increased 8% to \$1.64 billion. This resulted in an average profit margin of 6.7% for the quarter, down from 6.8% last year.

Improvement in results seems to be worldwide for most companies. At Union Carbide, for instance, only Latin America showed a decline in operating profit for the quarter, and sales increased in all geographic regions. Monsanto had similar results. Dow Chemical points out that it set all-time quarterly records for sales and operating income in both the U.S. and Europe.

For the rest of the year most chemical executives see continued growth, but are tempering their forecasts with some caution. At Dow, president and chief executive officer Frank P. Popoff says, "There was continued growth in the first quarter with all indicators pointing toward a strong second quarter. While rising interest rates in the U.S. may constrain the interest-sensitive sectors of the economy, I'm confident 1989 will be another record year for Dow based on the quality of the first-quarter results and the continued strength of our global business."

And at Rohm & Haas where earnings were down 15%, chairman and chief executive officer J. Lawrence Wilson says, "In normal times Rohm & Haas reports earnings growth in strong economic environments. Thus, we are disappointed in our first-quarter results. The quarter-to-quarter comparisons should improve as the year progresses, if current economic levels are sustained. However, this may be an optimistic outlook if isolated instances of first-quarter softness become widespread in later quarters." □

Changes pushing companies toward globalization

Exploiting changing operating conditions in and between key regions and countries of the world will become more important to corporate success in the future, according to two speakers at the recent Chemical Marketing Research Association meeting in New York City.

"Within and between North America, Europe, and the Pacific Rim, the new global operating environment is pushing countries toward greater economic integration," says Frank R. Wyant, chief economist of Air Products & Chemicals. To survive, "chemical companies will have to operate within as well as between" these primary economic regions, he told the meeting.

And according to Koji Yoshida, assistant general manager of Mitsui Toatsu Chemical's U.S. office in New York City, "Globalization might be a necessity for the Japanese chemical industry" in order to survive globalization efforts by U.S. and European chemical giants. Mergers and acquisitions, he says, "might be one of the best ways" for Japanese chemical manufacturers to achieve both growth and globalization.

Most of the world's new information, knowledge, and technology will emanate from the primary spheres of North America, Western Europe, and Japan, Wyant says. Since most of the world's new products and processes will be developed in one of these three core areas over the next decade, "manufacturing competitiveness will depend increasingly on a corporation's ability to operate in all three primary manufacturing spheres."

The secondary industrial spheres—Latin America, the Pacific Rim, Africa, the U.S.S.R., Eastern Europe, and China—will depend "on the research, development, and commercialization of processes and products that take place in the primary spheres," Wyant says. Additionally, since the secondary spheres "do not offer world-scale markets, successful manufacturing operations in these areas will depend, directly or indirectly, upon international trade."

Wyant believes that as a result of international and industrial realignment, basic manufacturing industries such as steel, shipbuilding, and construction will shrink in North America, Western Europe, and Japan, as the newly industrialized countries' share of these industries grows. Newly industrialized countries also will provide competition, particularly in computers, electronics, and biotechnology. But over the next decade he believes that the great bulk of world manufacturing will remain concentrated in North America, Western Europe, and Japan.

North America will slightly lead Western Europe and Japan in the decade ahead, Wyant predicts. The 1979 and 1982 recessions as well as the dollar appreciations from 1983 to 1985 forced quality and efficiency improvements by North American manufacturers. They will be able to reap the benefit of these improvements in the decade ahead. And he thinks they also will benefit from "reasonably valued currencies and by liberalized trade."

As industrial growth surges in the

next decade, Wyant believes that "significant chemical market industry growth will take place in the auto, chemical, and electrical machinery industries." Extrapolating from statistics compiled from the United Nations Industrial Statistics Yearbook, Wyant predicts that North America will lead the chemicals and paper industries, the Pacific Rim will lead in electrical machinery and textiles, and that North America and the Pacific Rim will become equals in the automotive industry.

As for the chemical industry, North America, Europe, and the Pacific Rim accounted for 36%, 32% and 25%, respectively, of world chemical output, says Wyant. By 1998, he predicts, Europe will lose share to North America and the Pacific Rim. Then North America will contribute 39%, Europe 28%, and the Pacific Rim 28% of global chemical output.

Japan's chemical industry is not so highly developed or diversified as is the chemical industry in either Western Europe or the U.S., says Yoshida. Average sales of the five largest chemical companies in Japan were \$3.3 billion in 1987, compared with \$8.5 billion for the five largest U.S. producers and \$18.5 billion for the five largest Western European chemical companies. And although the U.S. and Europe have a chemical trade surplus, Japan has a slight deficit, he says.

Yoshida says that Japanese chemical companies have traditionally been domestically oriented. Japan's export ratio has been less than 10% of production, whereas the U.S. and Europe traditionally have exported a much greater portion of their production.

R&D expenditures for five large Japanese chemical companies averaged \$169 million in 1987, about one fourth of the average for five large U.S. chemical firms and one fifth of the largest European chemical firms, Yoshida says. However, the Japanese chemical industry has been increasing its R&D expenditures 10% annually. U.S. chemical company R&D expenditures have been growing at about the same rate (C&EN, June 20, 1988, page 55).

Japanese chemical companies might have to globalize their oper-

Europe's chemical giants dwarf biggest U.S., Japanese firms

\$ Billions	1987 sales	\$ Billions	1987 sales	\$ Billions	1987 sales
EUROPE		U.S.		JAPAN	
BASF	\$22.40	Du Pont	\$13.10	Mitsui Bussan	\$ 4.50
Bayer	20.60	Dow Chemical	10.80	Sumitomo Chemicals	3.73
Hoechst	20.60	Exxon	7.18	Showa Denko	3.00
ICI	18.40	Union Carbide	6.18	Ube	2.64
Ciba-Geigy	10.60	Monsanto	5.16	Mitsui Toatsu	2.63
TOTAL	\$92.60	TOTAL	\$42.42	TOTAL	\$16.50
AVERAGE	\$18.52	AVERAGE	\$ 8.48	AVERAGE	\$ 3.30

Source: Mitsui Toatsu Chemicals

ations as a "last chance" for survival, Yoshida says. Globalization is the only way to compensate the industry "by selling a newly developed product to a global market."

By targeting U.S. chemical companies for mergers and acquisitions, Japanese chemical companies hope "to meet the challenge of American chemical giants," says Yoshida. He believes that Japanese investment in the U.S. chemical industry will foster improved productivity and competitiveness for the U.S. chemical industry as a whole.

Marc Reisch

Steel processor eyes waste treating business

Often a problem can lead to a new business opportunity. A case in point is Meridian National Corp., a steel processor that had to dispose of a sulfuric acid waste stream.

Meridian National is a Toledo, Ohio-based distributor and processor of steel, primarily for the automotive and appliance businesses. Its pickling and steel oiling operations in the Midwest smokestack corridor generate a considerable volume of waste sulfuric acid. As the company has learned how to recycle that waste stream economically, its executives have chartered an expansion course with the aim of profitably treating and recycling metal-contaminated acid wastes generated by other smokestack businesses.

Between 1982 and 1985, the cost of disposing of sulfuric acid waste rose from 6 cents per gal to 42 cents per gal, says William D. Feniger, chairman and chief executive officer of Meridian National. The company found that it could recycle the sulfuric acid, which it uses to clean scale from the steel it processes. The ferrous sulfate heptahydrate removed in the regeneration process could then be sold to magnetic tape manufacturers such as 3M, and animal feed manufacturers such as Purina, as well as to fertilizer, vitamin, and paint pigment producers.

An initial capital investment of some \$700,000 allowed Meridian National to start up an acid regeneration facility operating as a separate

subsidiary, National Chemical Services, in 1987. By recycling the sulfuric acid generated at its two pickling facilities, the company was able to save \$500,000 yearly through its subsidiary, says Feniger. The recycling effort turned out so well, Meridian National decided to take a look at the acid waste streams generated by other companies in the area. In addition to sulfuric acid, there are hydrochloric and chromic acid as well as zinc waste—all generated in the metal treatment business with which the company is familiar.

Meridian National thought it might "go after other people's acids," and learned that "15% of the acids in our area can be economically regenerated," says Feniger. But there was a hitch. Potential customers "didn't want their recycled wastes back. They just wanted them to go away." And along with the regenerated acids that producers did not want back, there was the 85% of liquid waste streams from the auto and steel industry that could not be regenerated and still had to be disposed of.

These acid wastes, however, do not just go away, points out Feniger. Pressure from the Environmental Protection Agency as well as pending federal and state legislation are beginning to limit disposal options for acid waste streams. EPA will eliminate the disposal of acid waste streams, of the type Meridian National is prepared to process, from deep-well injection by 1990, he says. And interest is growing within federal and state legislatures to ban the interstate shipment of hazardous waste, he adds.

Another option for acid waste disposal, via wastewater treatment facilities, appears to be on the way out, says Feniger. Much of the iron-contaminated acid waste stream from the steel processing industry in the Midwest goes to local municipal wastewater treatment facilities where the waste acid is used to treat alkaline effluent. Many of the metal-contaminated municipal waste streams drain into Lake Erie, a source of drinking water for the communities on the lakeshore. "It's a joke. This can't go on," says Feniger.

The limitations soon to be placed

on acid waste disposal will provide a niche for Meridian National's National Chemical Services. After three years and an expenditure of some \$1.3 million, Meridian National received a final EPA-approved permit last September to build a facility in Detroit large enough to treat liquid acid wastes it can collect from nearby generators such as Great Lakes Steel and Rouge Steel. The Detroit area alone generates about 300,000 gal of liquid hazardous waste daily.

Meridian National plans to recover not only ferrous sulfate heptahydrate from spent sulfuric acid, but also ferrous chloride from hydrochloric acid, and other marketable raw materials from other acid wastes it processes. Whatever acids cannot be recycled for sale will be filtered and the clarified liquid will be neutralized and can be flushed into the sewer system, says Feniger. The filtered solids, he says, can be buried in a nonhazardous waste landfill.

The National Chemical Services facility currently can handle 40,000 gal of waste daily; \$6 million of a recent \$7.5 million public offering of stock and warrants in Meridian National will finance a boost in capacity at the facility to 72,000 gal per day. Feniger says capacity at the Detroit facility will be easily expandable to 144,000 gal.

At its maximum capacity, the liquid waste treatment facility could be producing annual revenues of \$20 million to \$25 million "and be very profitable," according to Feniger.

Profits from National Chemical Services as well as the company's recent initiatives into solid waste landfill management and environmental consulting might help provide a less volatile performance for the steel services company. Meridian National's revenues for the fiscal year ending Feb. 28 were \$57 million, up 90% from the comparable period in 1988. However, net profit, \$252,000, was down 48%.

Meridian National has no intention of abandoning the steel services business. Its steel distribution, oiling, and pickling operations will "continue to grow and will be the building block for the company," Feniger says.

Marc Reisch